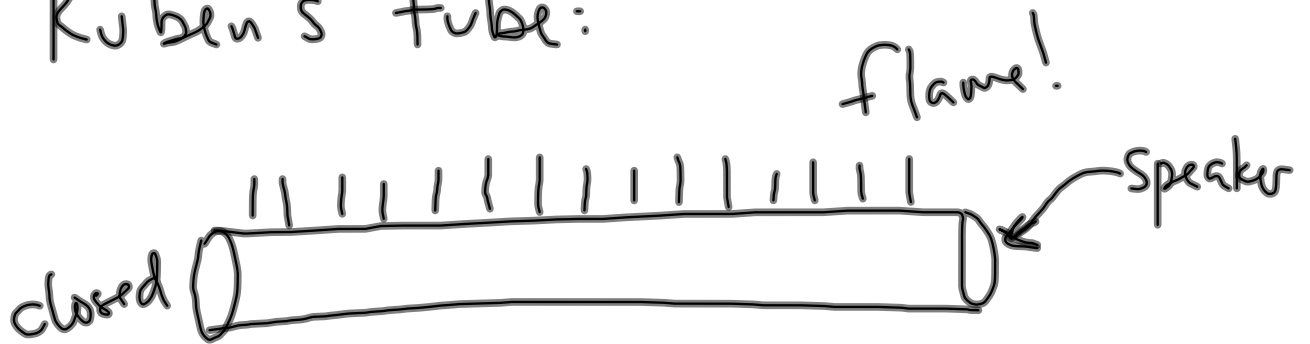
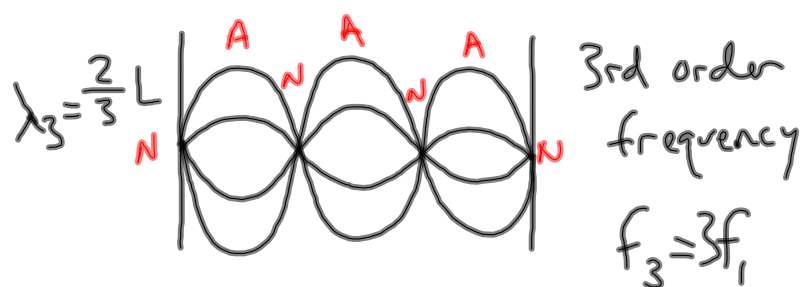
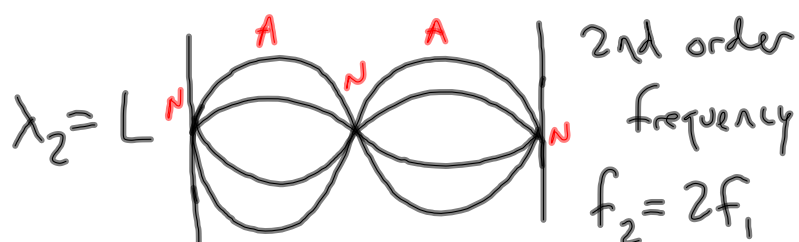
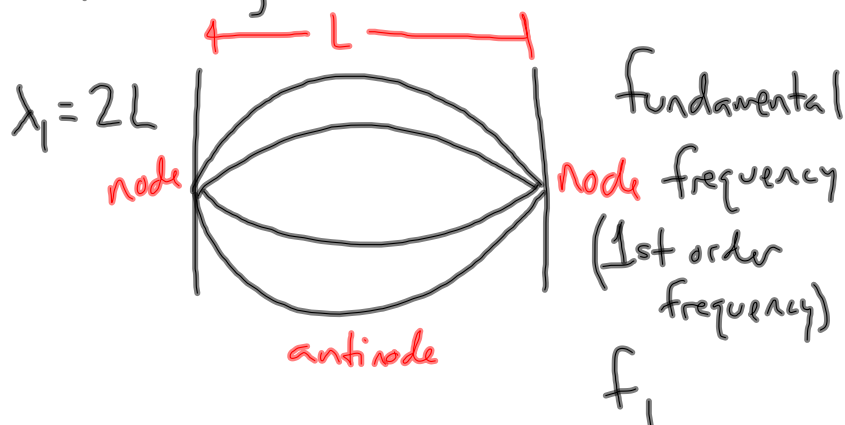


Ruben's tube:



Standing wave is created in the tube, and the flames represent the nodes and antinodes.

## Standing Waves:



$$f_n = \frac{nv}{2L} \quad n = 1, 2, 3, \dots$$

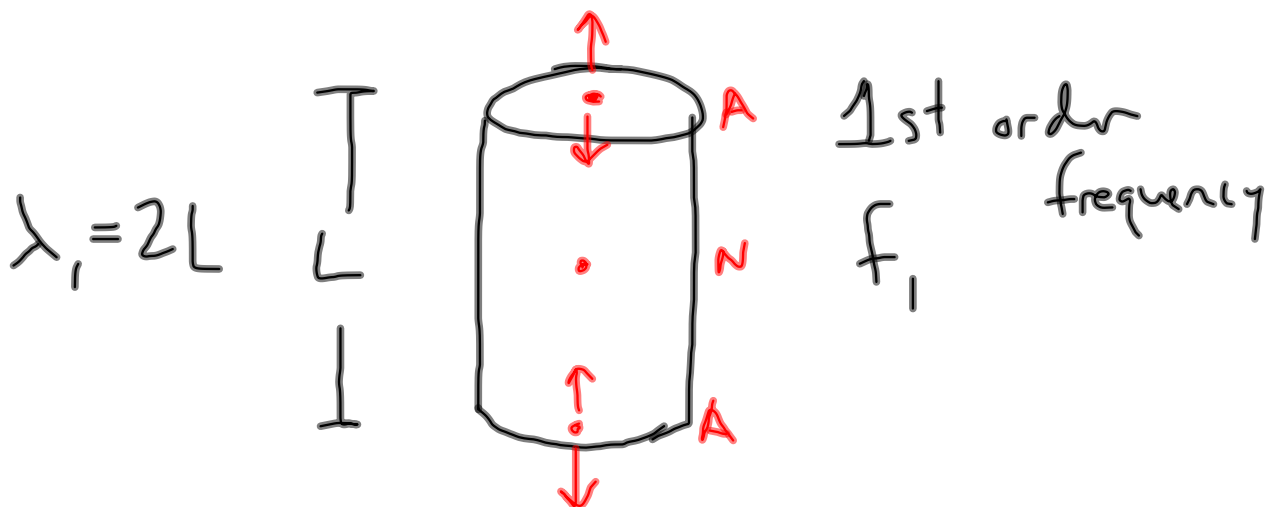
$f_n \rightarrow$  frequency of the  $n$ th harmonic

$n \rightarrow$  harmonic number

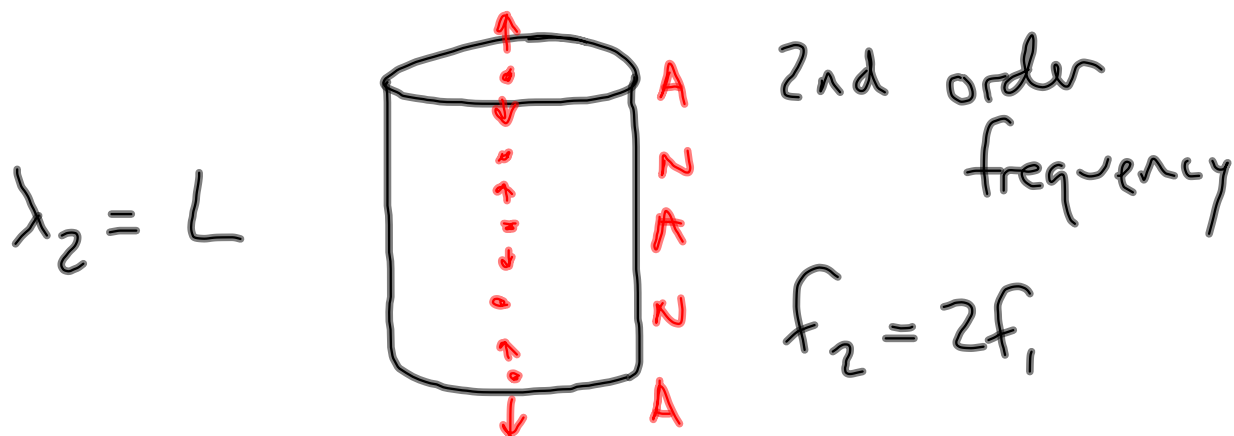
$v \rightarrow$  speed of wave on the string

$L \rightarrow$  length of the string

Open/Open pipe:



there must be antinodes at the ends of pipe



$$f_n = \frac{nv}{2L}$$

$v \rightarrow$  speed of sound in air ( $\sim 343 \text{ m/s}$ )